TEST REPORT

Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz band; Harmonised Standard for access to radio spectrum

Report Reference No. ..... :	422879-1TRFWL	
Tested by (name, function and signature) ..... :	P. Barbieri	(project handler)
Approved by (name, function and signature) ..... :	D. Guarnone	(verifier)
Date of issue ..... :	2021-05-31	
Testing Laboratory ..... :	**Nemko Spa**	
Address ..... :	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy	
Testing location	Nemko Spa	
Address ..... :	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy	
Applicant's name ..... :	**Aesys SpA**	
Address ..... :	Via Artigiani, 41 – 24060 Brusaporto (BG) – Italy	
Test specification:		
Standard ..... :	ETSI EN 300 328 V2.2.2	
	Full application of the standards	☐
	Partial application of the standards	☒
Test procedure ..... :	Nemko WM L0077, WM L0177 and WM L1002	
Test Report Form No. ..... :	300328TRF	
TRF Originator ..... :	Nemko Spa	
Master TRF ..... :	2017-10	

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Test item description ..... :	**Monitor**
Trade Mark ..... :	aesys
Manufacturer ..... :	Aesys SpA
Address of manufacturer ..... :	Via Artigiani, 41 – 24060 Brusaporto (BG) – Italy
Code ..... :	993202033501
Model name ..... :	CPTOU4615 LS P1L3ARIO2HS24G1WTTSPFACZ0
Ratings ..... :	220 – 240 V~, 50 / 60 Hz

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Test Report No. :	422879-1TRFWL	2021-05-31 Date of issue

Short description of the EuT	Copy of marking plate
The E.U.T. a information monitor provided with an internal PC. The EUT use the following separatly approved radio module: - LTE/HSPA+/GSM module SIMCom model SIM7100E-PCIE - WIFI radio module Sparklan model WUBA-171GN - PMR radio module Elancitè model NF S32-002 - Antenna type Invax model DR70 The EUT is provided also with a slim soundbar code 993301701000 (Slim Soudbar 46" MC).	

Number of tested samples:	1
Serial number:	899707
Antenna type:	External connector with dedicated antenna
Assigned band:	2.4 GHz to 2.4835 GHz
Modulation type:	WIFI standard
Equipment use:	Fixed equipment
Accessories and detachable parts included:	The E.U.T. is composed of a single unit
Other options included:	--

Testing

Date of receipt of test sample:	2021-05-13
Testing commenced on:	2021-05-17
Testing concluded on:	2021-05-28

Possible test case verdicts:

test case does not apply to the test object:	N (Not applicable)
test object does meet the requirement:	P (Pass)
test object does not meet the requirement:	F (Fail)

Symbols used in this test report

☒ The crossed square indicates that the listed condition or equipment is applicable for this report.

☐ The empty square indicates that the listed condition or equipment is not applicable for this report.

Throughout this report point is used as decimal separator.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Verdict according to the standards listed at page 5:	**Pass**

PROJECT HISTORY		
Report number	**Modification to the report / comments**	**Date**
422879-1TRFWL	First release	2021-05-31
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REMARKS		

PRODUCT VARIANTS COVERED BY THIS REPORT		
Variant model	**Difference against the main model**	**Additional test performed**
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REMARKS		

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1 TEST STANDARDS

The tests were performed according to following standards and procedures.

NEMKO WM L0177: General routines for using instruments at Nemko

NEMKO WM L1002: Measurement Uncertainty - Policy and Statement

NEMKO WM L0077: General routines to perform EMC tests

ETSI EN 300 328 V2.2.2
Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz band; Harmonised Standard for access to radio spectrum

2 SUMMARY OF TEST RESULTS

Harmonised Standard ETSI EN 300 328				
Requirement		Requirement Conditionally		Test Result
No	Description	U/C	Condition	
1	RF Output Power	U		P
2	Power Spectral Density	C	Only for equipment using wide band modulations other than FHSS	(1)
3	Duty cycle, Tx-Sequence, Tx-gap	C	Only for non-adaptive equipment	(1)
4	Accumulated Transmit time, Frequency Occupation & Hopping Sequence	C	Only for FHSS equipment	(1)
5	Hopping Frequency Separation	C	Only for FHSS equipment	(1)
6	Medium Utilisation	C	Only for non-adaptive equipment	(1)
7	Adaptivity	C	Only for adaptive equipment	(1)
8	Occupied Channel Bandwidth	U		(1)
9	Transmitter unwanted emissions in the OOB domain	U		(1)
10	Transmitter unwanted emissions in the spurious domain	U		P
11	Receiver spurious emissions	U		(1)
12	Receiver Blocking	U		(1)
13	Geo-location capability	C	Only for equipment with geo-location capability	(1)

Symbols:
U/C Indicates whether the requirement is to be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).

NOTE 1: The EUT is use a separately approved radio module, so the standard has been partially applicated.

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Power supply voltage:	☒	230 V / 50 Hz / 1ϕ	☐	115 V / 60Hz / 1ϕ
	☐	400 V / 50 Hz 3PE	☐	400 V / 50 Hz 3NP
	☐	12 V DC	☐	24 V DC

3.2 EuT operation modes

Mode	Description
1	TX mode forced by a radio communication tester

3.3 EuT configuration modes

The EuT was configured to measure its highest possible radiation level. The test modes selected are according to EuT instruction manual.

Mode	Description
1	The EUT has been connected to the mains with the Ethernet cable connected to a PC.

3.4 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
0	Enclosure	N/E	—	—	—
1	AC mains	AC	☒	☐	Three wires cable
2	Ethernet line	TP	☒	☒	Standard cable

*Note:

AC = AC Power Port DC = DC Power Port N/E = Non-Electrical

I/O = Signal/Control Input or Output Port TP = Telecommunication Port ANT = Antenna Port

3.5 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
AE	PC	—	—	—
AE	Radio communication tester	R&S	CMW 290	—
AE	PMR Remote control	Okeenea	TX1-BUZ	—
AE	IR Remote control	Meliconi	Speedy 2 combo	—

Note: * Use

EUT - Equipment Under Test

AE - Auxiliary/Associated Equipment (Not Subjected to Test)

SIM - Simulator (Not Subjected to Test)

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

Nemko Spa
Via del Carroccio, 4
20853 Biassono (MB) - Italy

Tests site/benches are in accordance with applicable standard/s, and have been utilized by Nemko Spa testing engineer(s).

4.2 Environmental conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Ambient temperature:	18 ÷ 33 °C (1)
Relative Humidity:	25 ÷ 70 % (2)
Atmospheric pressure:	860 ÷ 1060 hPa

(1) For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C
(2) During ESD test, humidity was verified to be within 30 ÷ 60 %

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

4.3 Statement of the measurement uncertainty

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

5 TEST CONDITIONS AND RESULTS

5.1 RF output power

5.1.1 Photo documentation of the test set-up

5.1.2 Test method

The RF output power is defined as the mean equivalent isotropically radiated power (e.i.r.p.) of the equipment during a transmission burst. The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

In the case of equipment intended for use with an integral antenna and where no external (temporary) antenna connectors are provided, a test fixture may be used to perform relative measurements at the extremes of the operating temperature range.

In case of conducted measurements the transmitter shall be connected to the measuring equipment by a suitable method. Use a fast power sensor suitable for 2.4 GHz and capable of 1 MS/s. Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Find the start and stop times of each burst in the stored measurement samples. Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst. The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations. Add the (stated) antenna assembly gain "G" in dBi of the individual antenna. If applicable, add the additional beamforming gain "Y" in dB. The RF Output Power (P) shall be calculated using the formula: P = A + G + Y
When performing radiated measurements, the UUT shall be configured and antenna(s) positioned (including smart antenna systems and equipment capable of beamforming) for maximum e.i.r.p. towards the measuring antenna. This position shall be recorded. A test site as described in annex B of EN 300 328 and applicable measurement procedures as described in annex C of EN 300 328 shall be used.

5.1.3 Limits

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm. The maximum RF output power for non-adaptive Frequency Hopping equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm. This limit shall apply for any combination of power level and intended antenna assembly.

5.1.4 Test result

Standard	Channel	RF measured (dBm)	Antenna gain (dB)	RF output power (dBm)
WIFI	LOW	12.5	2	14.5
WIFI	MID	13.0	2	15.0
WIFI	HIGH	12.4	2	14.4

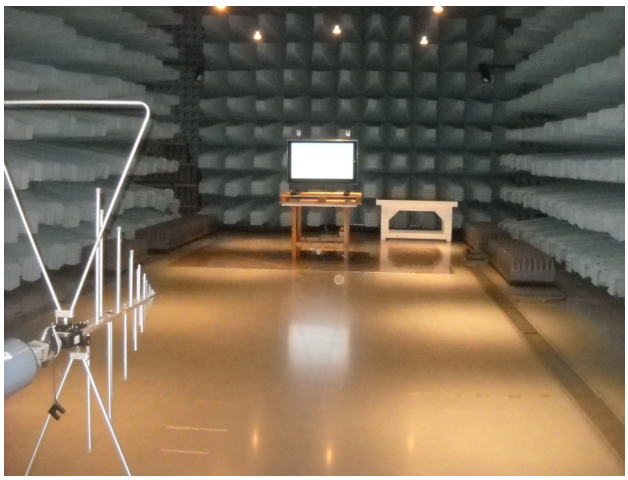
Verdict:	☒ P ☐ F ☐ N
Test frequency:	WIFI: 2412 MHz, 2442 MHz and 2472 MHz
Operation mode:	1
Configuration mode:	1
Kind of test site:	Shielded room
Remarks: The EMI receiver is used also as fast power sensor.	

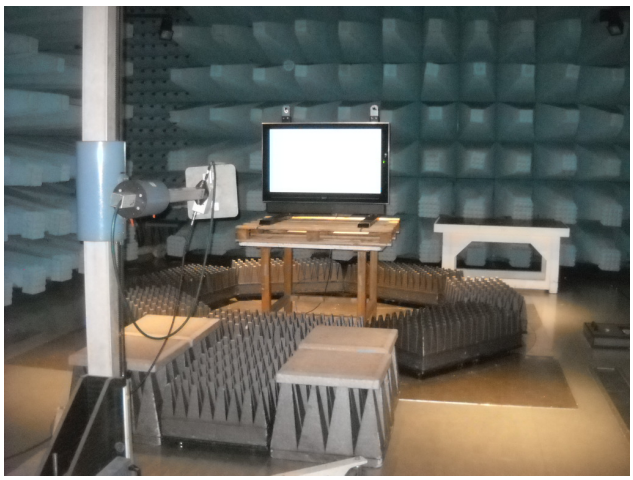
5.1.5 Test equipment used

Equipment	Manufacturer	Model	Serial N°
EMI receiver (2 Hz ÷ 44 GHz)	R&S	ESW44	101620
Power sensor	R&S	NRP18AN	100987
Redio communication tester	R&S	CMW290	2.488
Shielded room	Siemens	Conducted emission test room	1862

5.2 Transmitter unwanted emissions in the spurious domain

5.2.1 Photo documentation of the test set-up





5.2.2 Test method

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain when the equipment is in Transmit mode.

These measurements shall only be performed at normal test conditions. For systems using FHSS modulation, the measurements may be performed when normal hopping is disabled. In this case measurements need to be performed when operating at the lowest and the highest hopping frequency. When this is not possible, the measurement shall be performed during normal operation (hopping). The equipment shall be configured to operate under its worst case situation with respect to output power. If the equipment can operate with different Occupied Channel Bandwidths, then the equipment shall be configured to operate under its worst case situation with respect to spurious emissions.

The test site as described in annex B of ETSI EN 300 328 and applicable measurement procedures as described in annex C of ETSI EN 300 328 shall be used. The spectrum analyser shall be set as show in relevant clause of the standard ETSI EN 300 328. The spectrum in the spurious domain shall be searched for emissions that exceed the limit values given in the following table or that come to within 6 dB below these limits. Each occurrence shall be recorded.

5.2.3 Limits

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in the following table.

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm e.r.p.	100 kHz
47 MHz to 74 MHz	-54 dBm e.r.p.	100 kHz
74 MHz to 87.5 MHz	-36 dBm e.r.p.	100 kHz
87.5 MHz to 118 MHz	-54 dBm e.r.p.	100 kHz
118 MHz to 174 MHz	-36 dBm e.r.p.	100 kHz
174 MHz to 230 MHz	-54 dBm e.r.p.	100 kHz
230 MHz to 470 MHz	-36 dBm e.r.p.	100 kHz
470 MHz to 694 MHz	-54 dBm e.r.p.	100 kHz
694 MHz to 1 GHz	-36 dBm e.r.p.	100 kHz
1 GHz to 12.75 GHz	-30 dBm e.i.r.p.	1 MHz

5.2.4 Test result

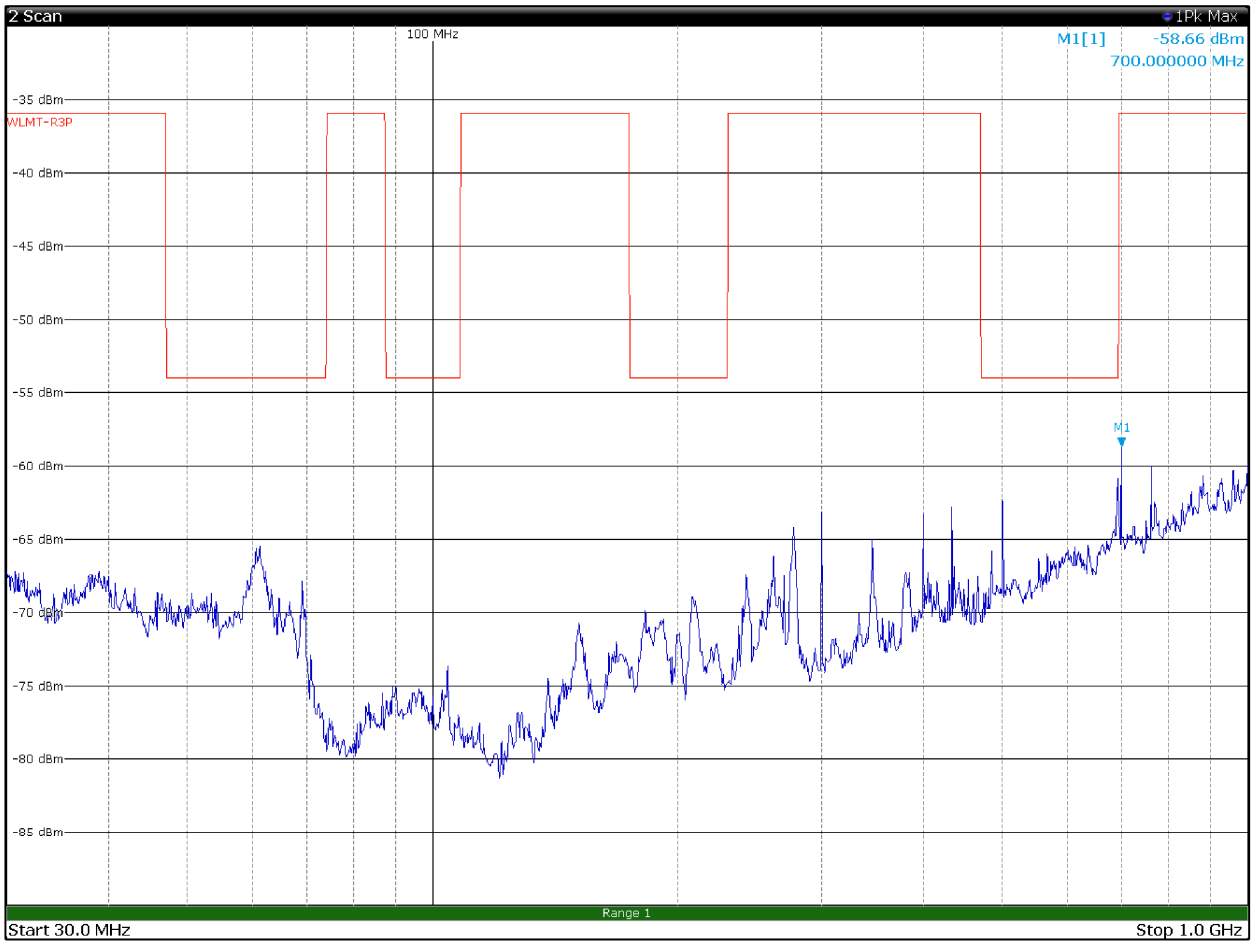
Verdict:	☒ P ☐ F ☐ N
Frequency range:	30 MHz to 12.75 GHz
Measurement distance:	10 m and 3 m
Kind of test site:	Semi anechoic chamber
Remarks:	

5.2.5 Test equipment used

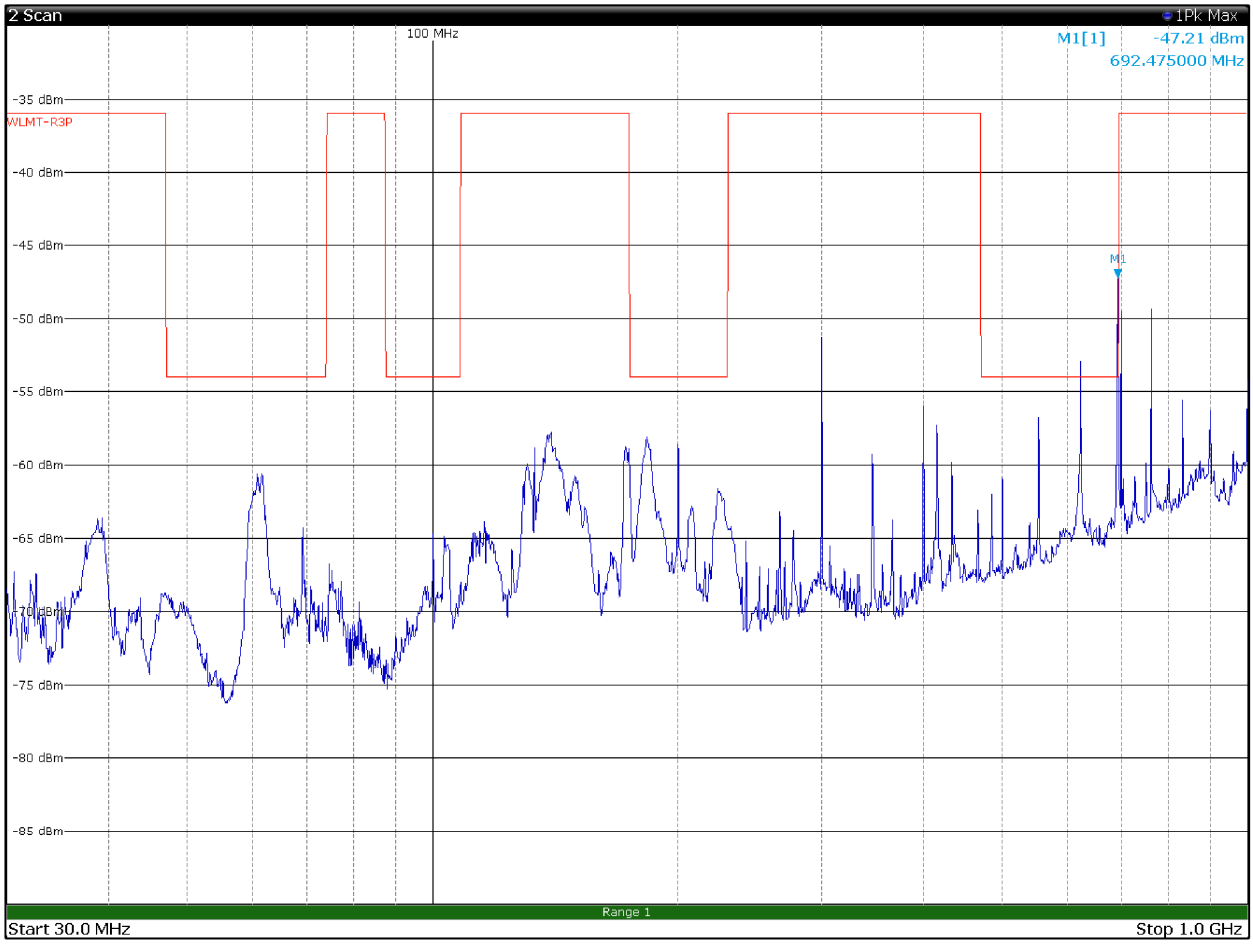
Equipment	Manufacturer	Model	Serial N°
EMI receiver (2 Hz ÷ 44 GHz)	R&S	ESW44	101620
Trilog Antenna (25 MHz ÷ 2 GHz)	Schwarzbeck	VULB 9162	9162-025
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148-123	123
Broadband preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137
Controller	Maturo	FCU3.0	10041
Tilt antenna mast	Maturo	TAM4.0-E	10042
Turntable	Maturo	TT4.0-5T	2.527
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530
Shielded room	Siemens	10m control room	1947

5.2.6 Test protocol

Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 30 to 1000 MHz

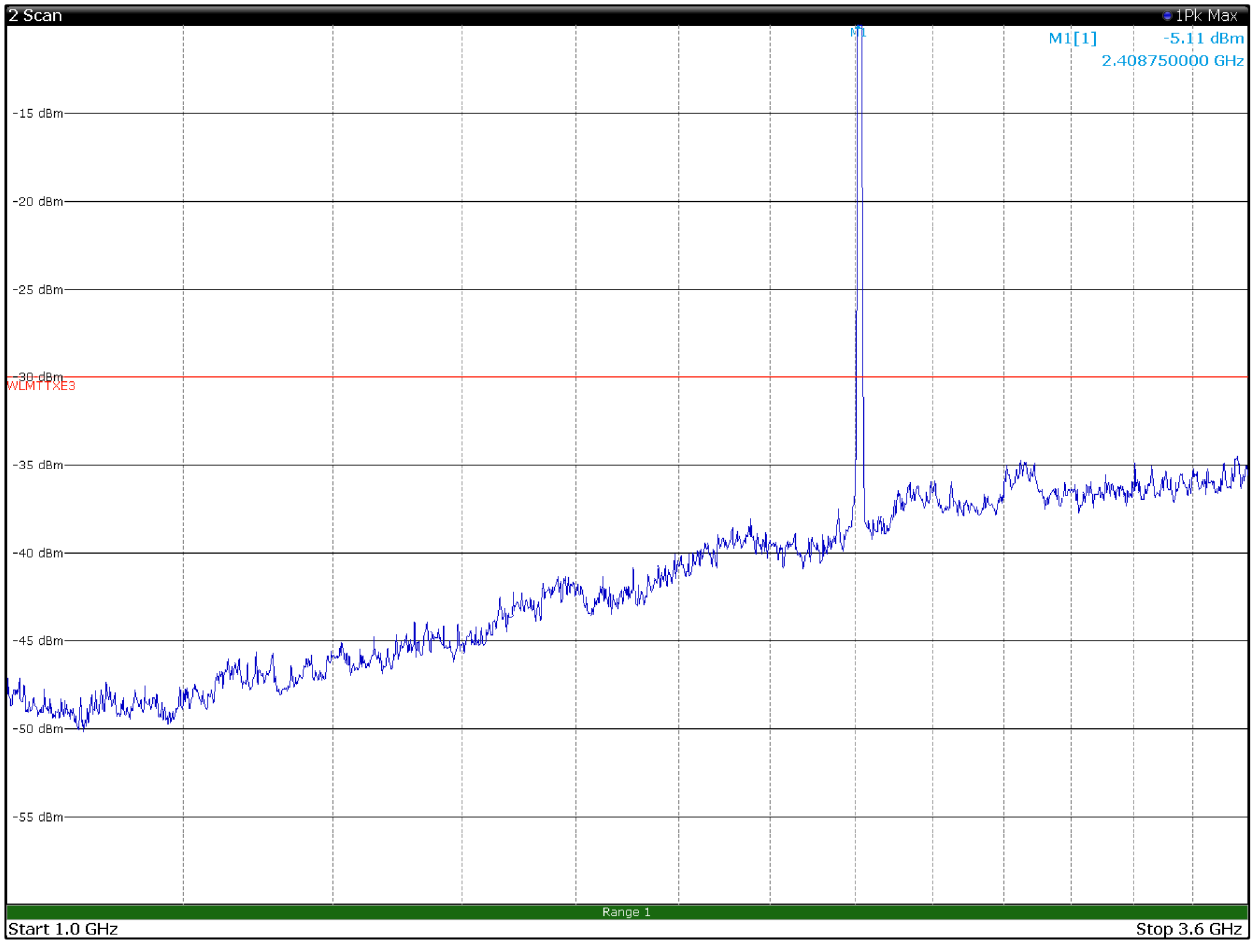


Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 30 to 1000 MHz



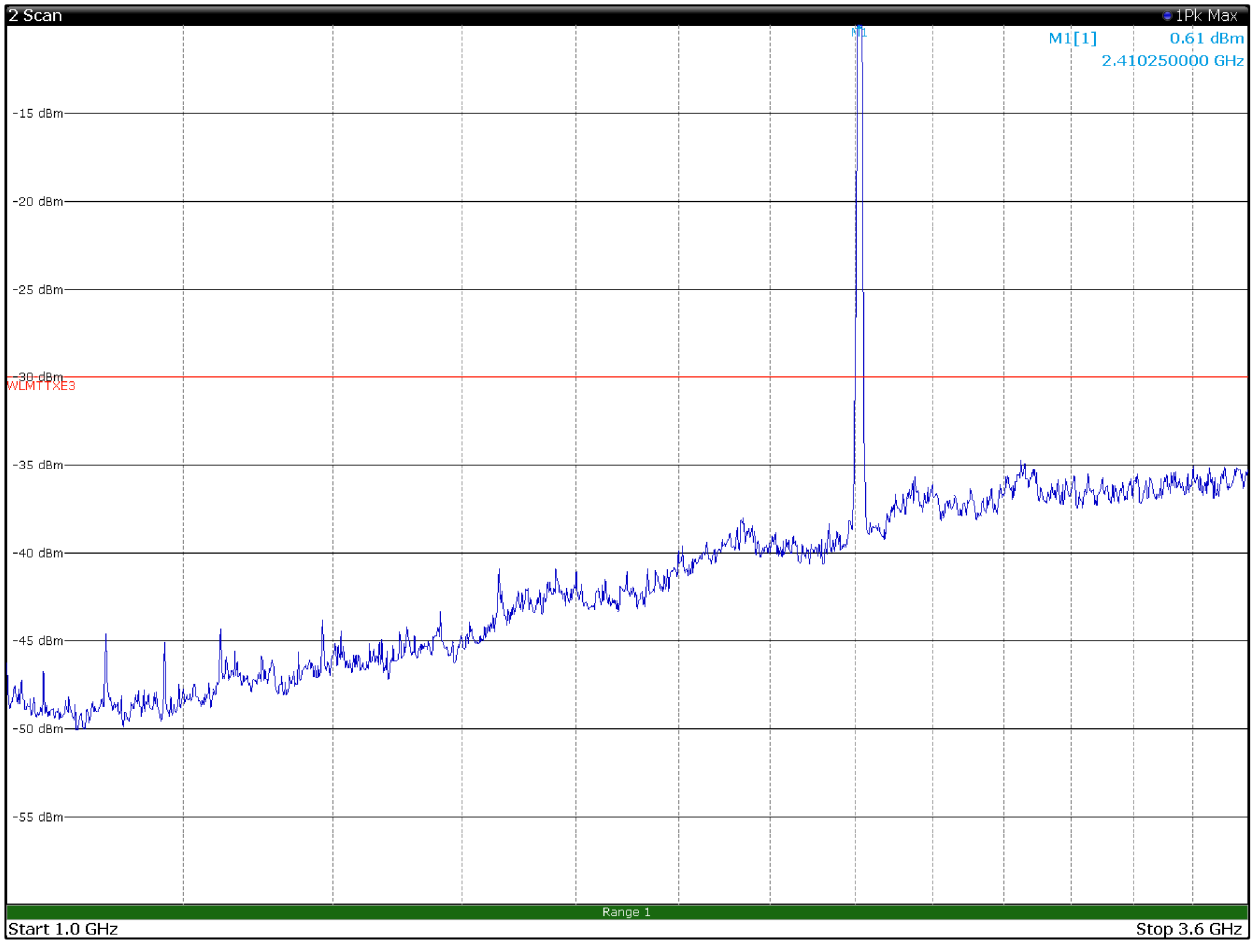
Limit exceeded by the radiated emissions of the hosting device (see EMC test report)

Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 1 to 3.6 GHz



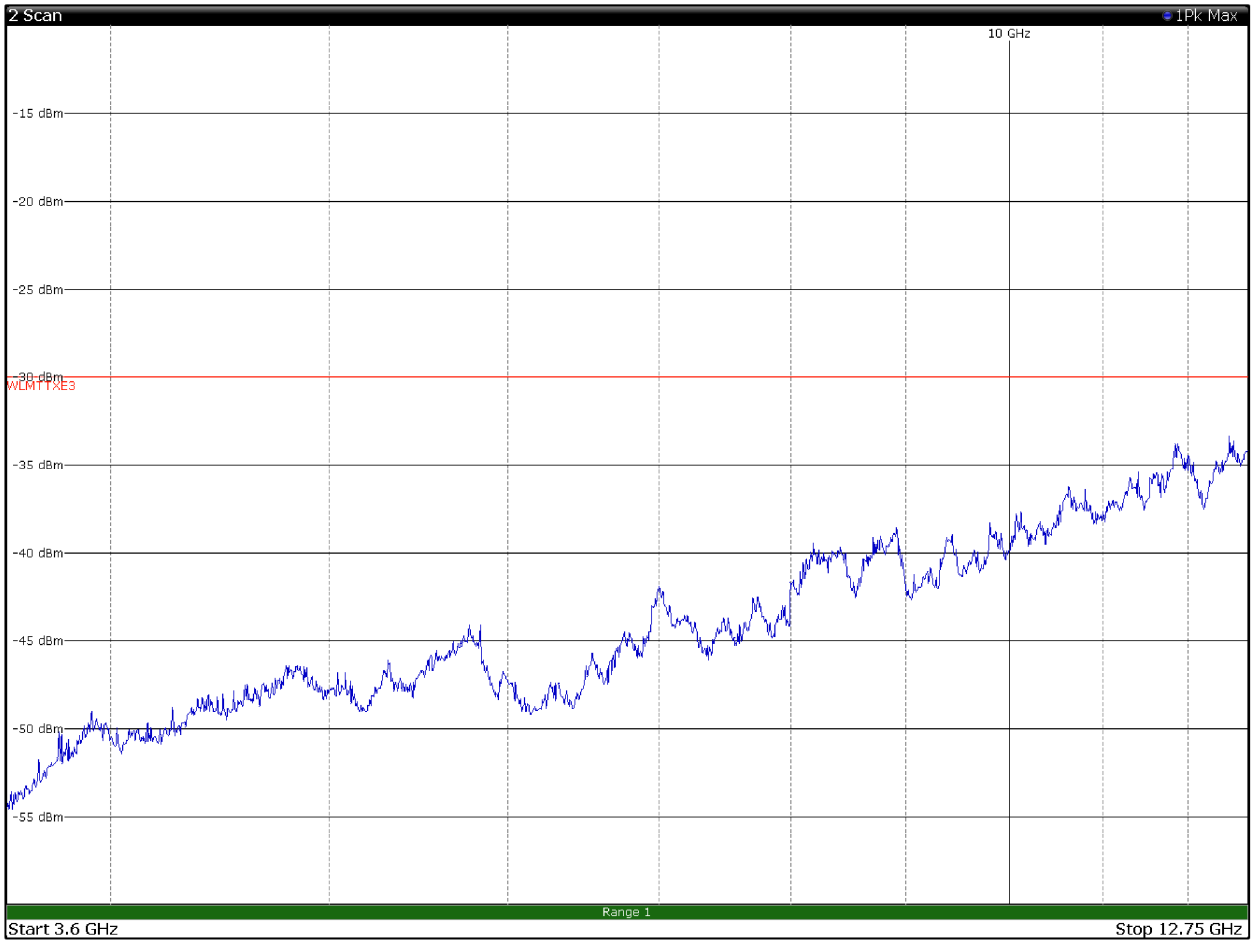
Limit exceeded by the carrier

Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 1 to 3.6 GHz

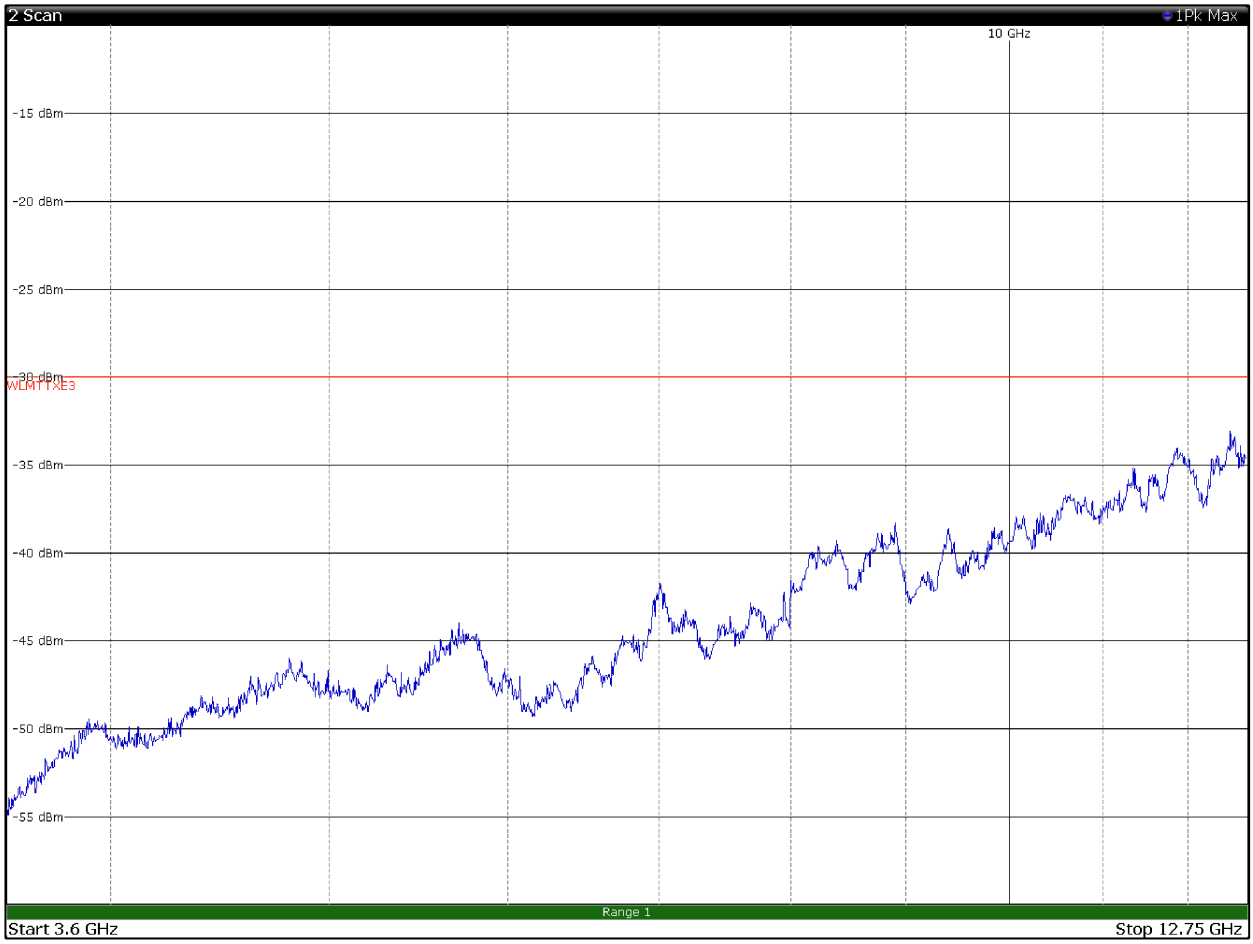


Limit exceeded by the carrier

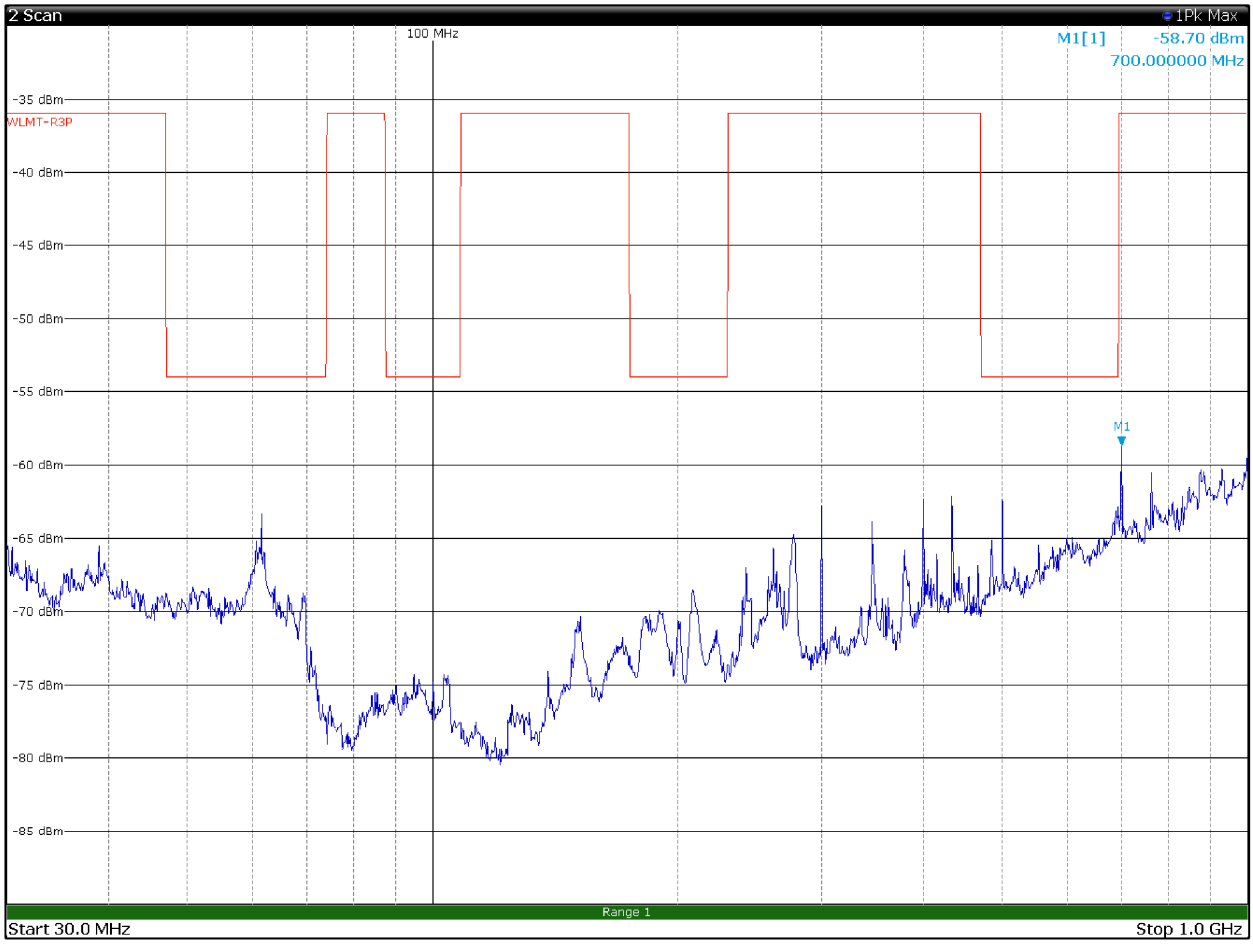
Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 3.6 to 12.75 GHz



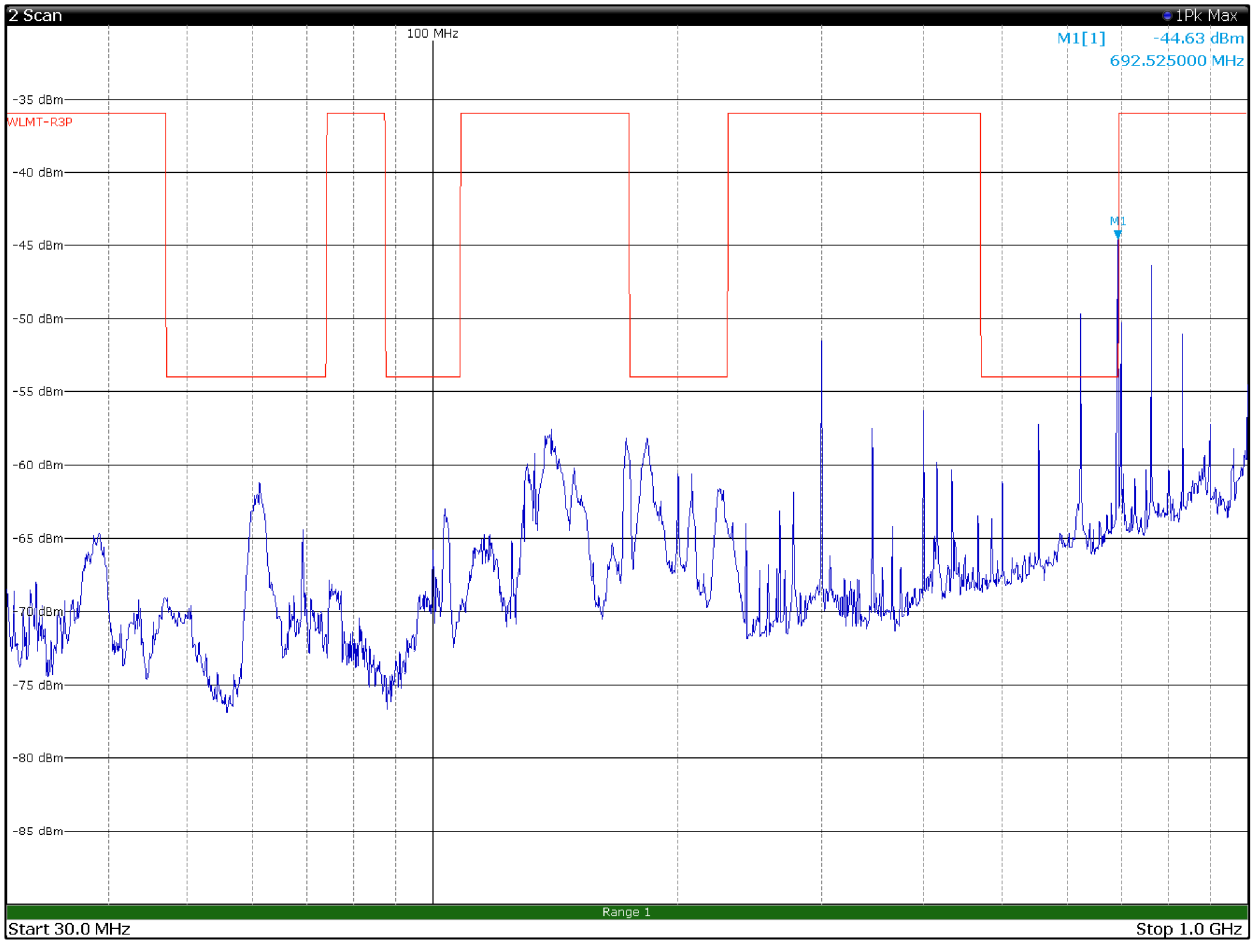
Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: LOW
Remarks: WIFI – Frequency range 3.6 to 12.75 GHz



Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 30 to 1000 MHz

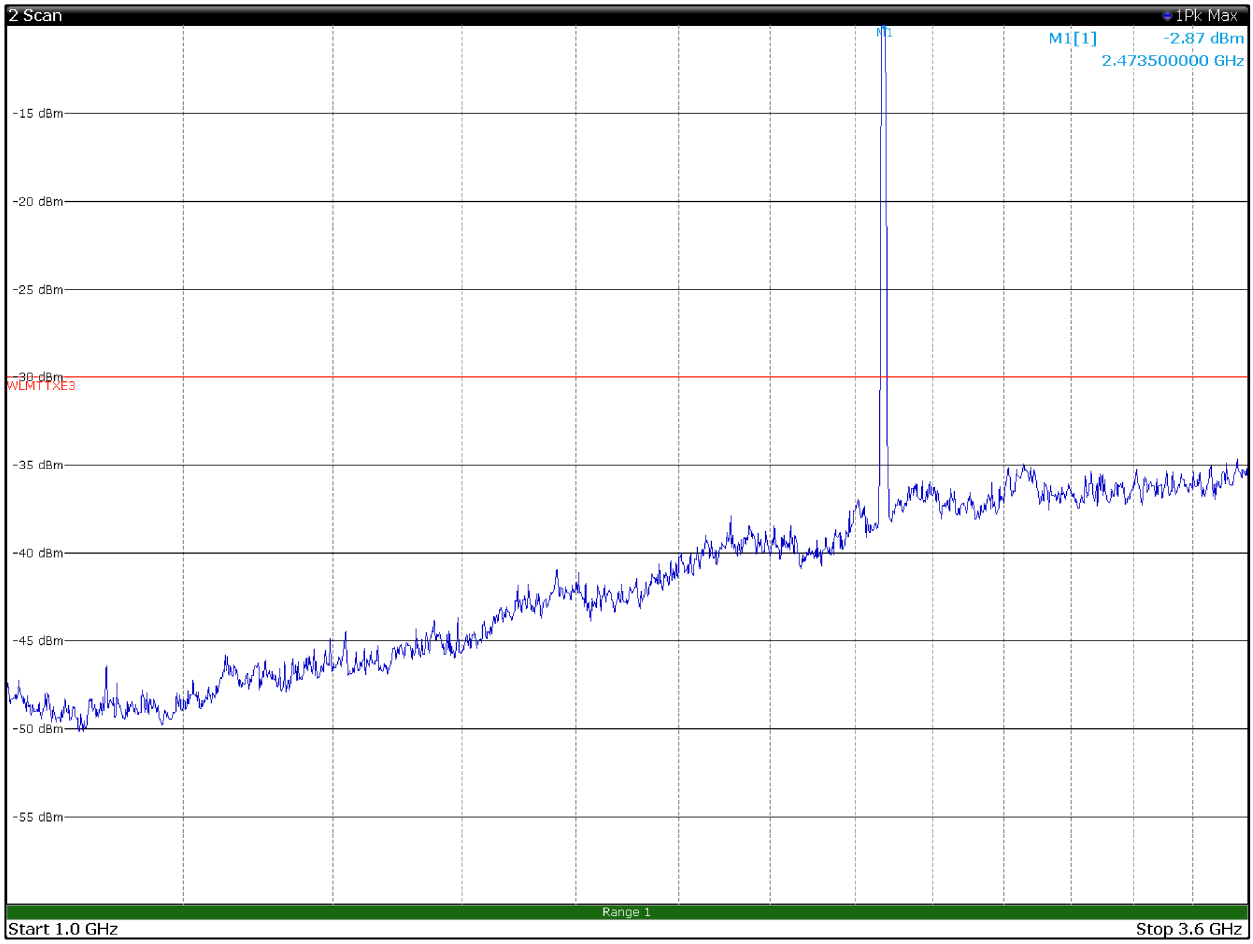


Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 30 to 1000 MHz



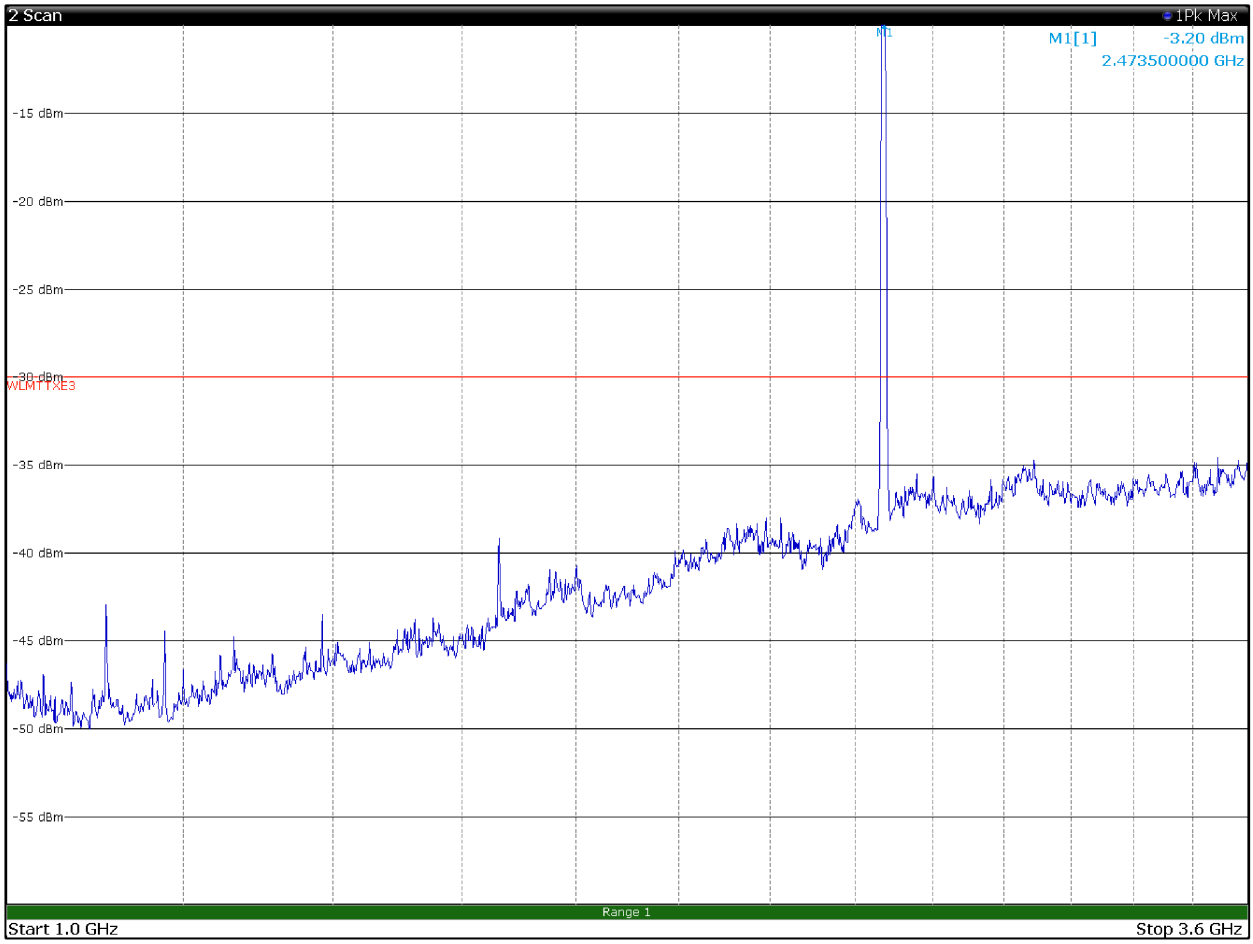
Limit exceeded by the radiated emissions of the hosting device (see EMC test report)

Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 1 to 3.6 GHz



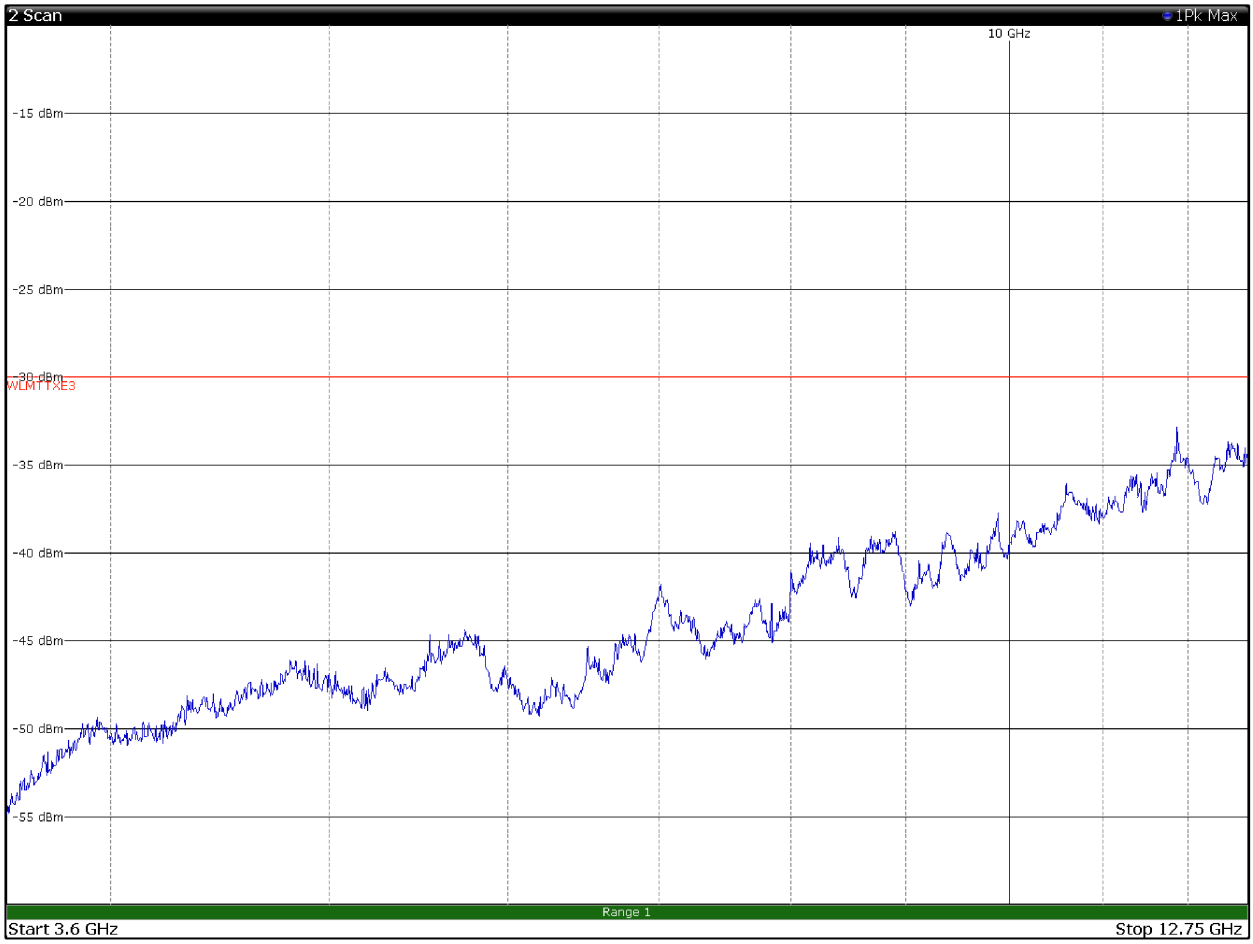
Limit exceeded by the carrier

Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 1 to 3.6 GHz

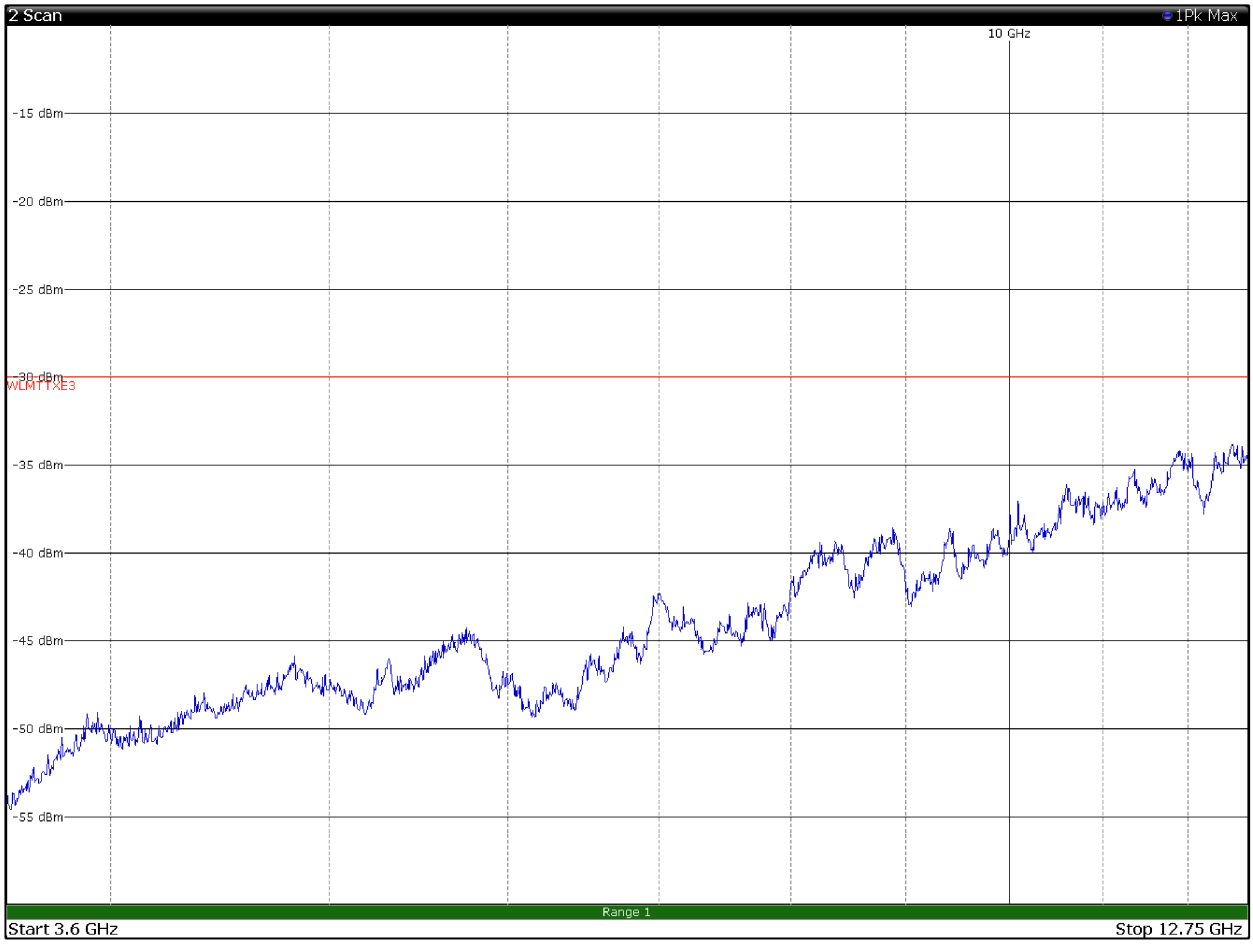


Limit exceeded by the carrier

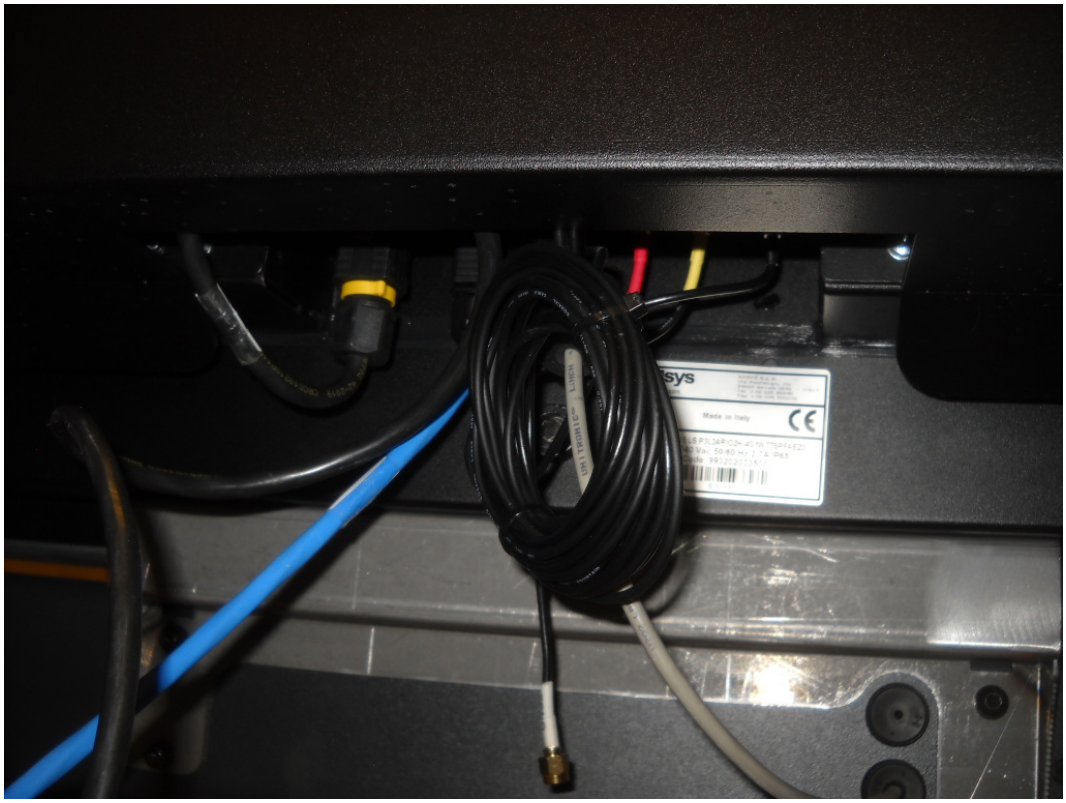
Antenna polarization: Horizontal Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 3.6 to 12.75 GHz



Antenna polarization: Vertical Verdict: Pass
Operation mode: 1
Configuration mode: 1
Chanel: HIGH
Remarks: WIFI – Frequency range 3.6 to 12.75 GHz



6 EUT PHOTOS



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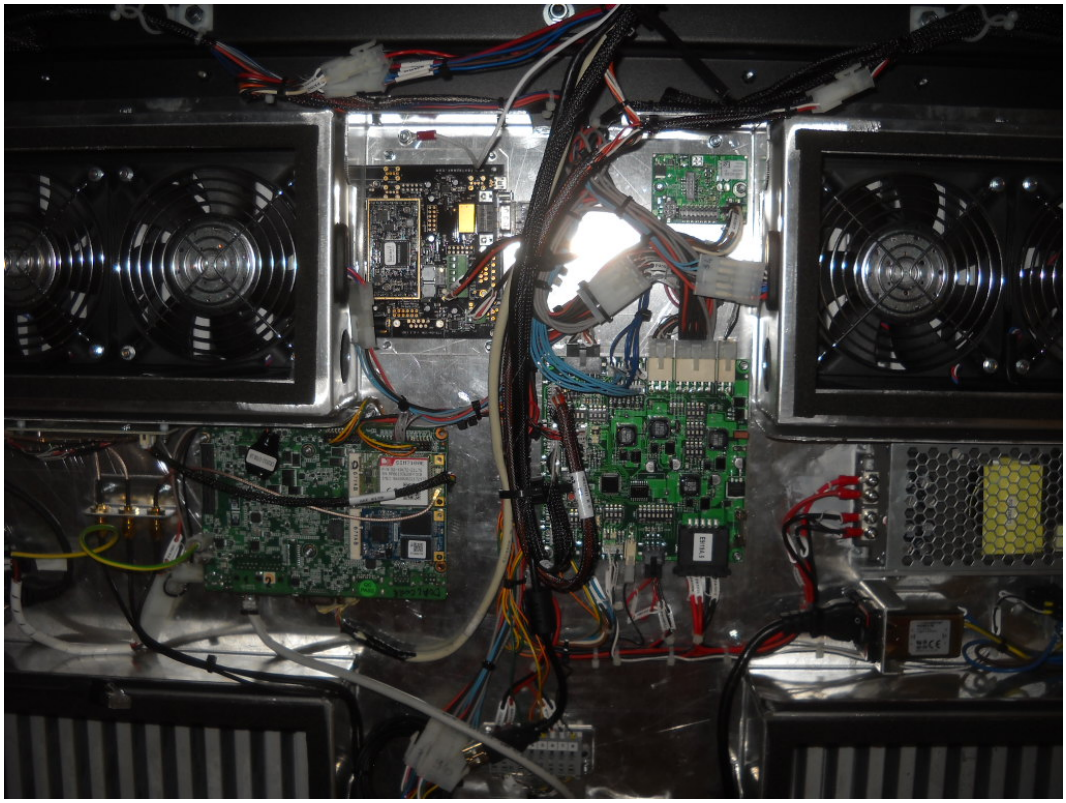

End of report